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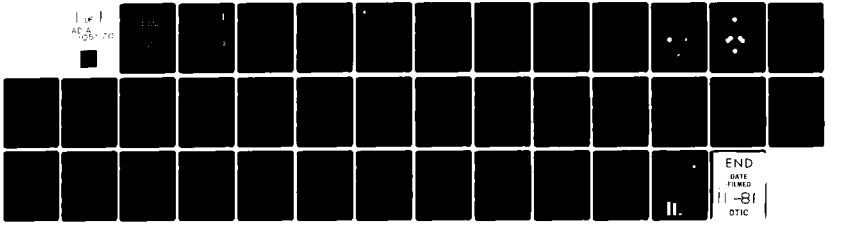

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# DEFENSE TECHNICAL INFORMATION CENTER FREE TEXT EXPERIMENT–MANAGEMENT DATA BASES

Carlynn J. Thompson

October 1981

Final Report



Office of Information Systems and Technology
Defense Technical Information Center
Cameron Station
Alexandria, Virginia 22314

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DTIC has conducted an experiment that utilizes the free text inversion technique to retrieve records from the DROLS management data bases. It was felt that free text inversion as a form of retrieval would be beneficial in supporting DTIC's revitalized role in the transfer of technical information. The intent of this project was to determine if the free text inversion technique could be implemented in the management data bases without severely impacting the on-line system. Response time, storage capacity and relevance of reports were the major areas of concern.

Based on the results of the experiment, it was determined that searching by free text is a viable retrieval technique in the management databases that will provide searchers with an additional enhancement that can be used to augment DTIC's present retrieval methods.

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DTIC-J

October 81

PREFACE

Experimentation in the Defense RDT&E On-Line System (DROLS) with free text searching extends back to December 1979 when preliminary testing was conducted in the Technical Reports Data Base (TR). Once the capability was explored in the TR system, it was decided to apply and test the technique on the Research and Development Program Planning Data Base (R&DPP), the Research and Technology Work Unit Information System Data Base (WUIS), and the Independent Research and Development Data Base (IR&D). These data bases provide technical and fiscal information about Department of Defense related R&D programs, so within DTIC, they are generally referred to as the management data bases.

The Directorate of Data Systems in cooperation with the Office of Information Science and Technology implemented and tested free text searching in the management data bases. This report was prepared in an effort to describe the implementation of free text and the test results.

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## INTRODUCTION

In an effort to upgrade technical information services to the Defense research and development community, the Defense Technical Information Center (DTIC) initiated a project to study other DoD, federal and commercial on-line systems capabilities during 1979. One of the common capabilities among the systems evaluated was the ability to retrieve information via free text terms. The idea that free text searching is an important feature to be considered in requirements for future systems is supported in Information Retrieval On-Line by Lancaster & Fayen.[1]

> Future systems should be oriented toward natural language (e.g., of abstracts) rather than controlled vocabularies. Specialized information systems will require the specificity of natural language, and the full interactive, browsing capabilities of such systems will be exploited more efficiently if they include relatively substantial portions of natural language text. For the practitioners in a field, natural language is almost essential. We cannot expect such users to learn the nuances and idiosyncracies of a large controlled vocabulary based on years of indexing practice and protocol. In addition to being highly desirable, natural language systems are becoming increasingly feasible because of the increasing availability of machine-readable data bases as by-products of other operations, and because of the fact that digital storage costs are coming down and are likely to come down much further with the development of mass storage devices of various types.

During 1980 through 1981 the Office of Data Systems in cooperation with Office of Information Science and Technology developed the capability of free text searching in the Defense RDT&E On-line System (DROLS). The purpose of this paper is to describe the implementation and testing of free text searching in the management data bases.

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1. F.W. Lancaster and E.G. Fayen, Information Retrieval On-line (Los Angeles, California: John Wiley & Sons, Inc., 1973), p. 413.

"Free text searching" for the DTIC experiment is defined as: single terms or words that have been extracted from narrative portions of the data base that can be retrieved directly from the inverted file. In other online systems, such as the National Library of Medicine/MEDLARS or the Systems Development Corporation/ORBIT™, "free text" may be referred to as full text, natural language, text words, or uncontrolled terms. The information community has not yet chosen a standard, so for purposes of this paper the phrase "free text" will be employed.

## BACKGROUND

Searching by free text is very similar to searching by descriptors or open-ended terms. Conceptual analysis, or breaking the search question into concepts, is required. The major difference between controlled vocabulary searching and free text searching is the searcher must decide which of the variant text words are likely to distinguish relevant documents from irrelevant ones. In some ways free text searching is more difficult than controlled vocabulary searching because much of the burden of term selection is placed on the searcher; however, it offers a number of benefits which otherwise would not be realized. For instance, it is possible to look for documents with individual personal or product names. "Planck constant", "maxwell's rule", or "Pratt and Whitney" are examples of searches that would be easily handled by free text. It is also possible to reduce a search to a smaller number of elements than in a controlled vocabulary search. For example the free text term "clams" instead of the descriptor "shellfish" is a much narrower concept; therefore, a smaller portion of the file must be reviewed.[2]

For further clarification on the capabilities of free text searching, see the text word searching rules in appendix A.

Preliminary testing was conducted with the Technical Reports Data Base. Based on frequency counts and retrieval experience gained during the preliminary tests, a DTIC stopword list and free text searching rules were developed. (See appendix A and appendix B.) For further information on the Technical Reports test see DTIC Free Text Experiment - Technical Reports File.[3]

The free text programs were changed to process text for each of the management data bases and the on-line system programs were modified by adding a new role code (60) so free text terms could be isolated from other inverted file terminology. To retrieve free text terms the role code must be used; that is, they are left out of the search unless

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2. F.W. Lancaster, Information Retrieval Systems (New York: John Wiley & Sons, Inc., 1979), pp. 279-292.

3. J.L. Carney et al., DTIC Free Text Experiment - Technical Reports File (Alexandria, Va.: Defense Technical Information Center, 1981), pp. 1-7.

specifically requested. Once these modifications were made, free text searching was implemented consecutively in each of the management data bases: Research and Technology Work Unit, Research and Development Program Planning, and Independent Research and Development.

## EVALUATION AREAS

There were four questions that were of concern while implementing free text searching in the managment data bases:

1) How will relevance of retrieval be affected by free text?

2) Will the number of records retrieved be significantly larger?

3) How much larger will the management data base inverted files be?

4) How will computer response time be affected by the larger free text inverted files?

Each of the questions will be discussed separately in the results section.

## TEST CONSTRUCTION

To test free text searching in the management data bases, 29 descriptors from the DTIC Retrieval and Indexing Terminology (DRIT)[4]/ were randomly selected and converted to a free text searching format. For example, the index term RADAR CAMOUFLAGE would be searched in the free text format as well as the descriptor format:

Descriptor Strategy

| | |
|---|---|
| @SWU@ | (COMMAND) |
| RADAR CAMOUFLAGE | (DESCRIPTOR) |
| END | (COMMAND TERMINATOR) |

Free Text Strategy

| | |
|---|---|
| @SWU@ | (COMMAND) |
| ?6ORADAR | (ROLE CODE and SEARCH TERM) |
| AND | (BOOLEAN OPERATOR) |
| ?6OCAMOUFLAGE | (ROLE CODE and SEARCH TERM) |
| END | (COMMAND TERMINATOR) |

---

4. U.S., Department of Defense, Defense Technical Information Center, DTIC Retrieval and Indexing Terminology: Posting Terms with Hierarchy and KWOC (AD-A068-500), May 1979.

In addition, a comprehensive search strategy was constructed that would retrieve descriptors as well as free text terms.

Combination Strategy

| | |
|---|---|
| @SWU@ | (COMMAND) |
| RADAR CAMOUFLAGE | (DESCRIPTOR) |
| ?6ORADAR | (ROLE CODE and SEARCH TERM) |
| AND | (BOOLEAN OPERATOR) |
| RADAR CAMOUFLAGE | (DESCRIPTOR) |
| ?6OCAMOUFLAGE | (ROLE CODE and SEARCH TERM) |
| END | (COMMAND TERMINATOR) |

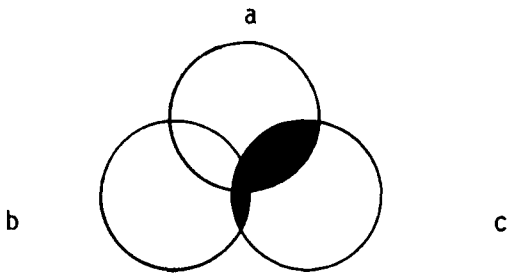
It should be noted that the descriptor appears on each level because DROLS does not allow the use of parenthesis in its Boolean logic. Putting descriptors on each level is a forced "OR" condition.

The following venn diagrams will clarify the logic. For searching the concept RADAR CAMOUFLAGE both the descriptor and the free text terms are of interest. We want to retrieve the descriptor and the conjunction of text words RADAR and CAMOUFLAGE.

(a) (b) (c)
RADAR CAMOUFLAGE OR RADAR AND CAMOUFLAGE


Without the parentheses the results would be:

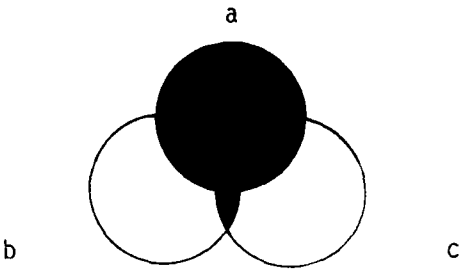
(a) (b) (c)
RADAR CAMOUFLAGE OR RADAR AND CAMOUFLAGE




because the "OR" operation is done first using Boolean logic.

Using parentheses would allow the searcher to signal which operation is to take precedence.

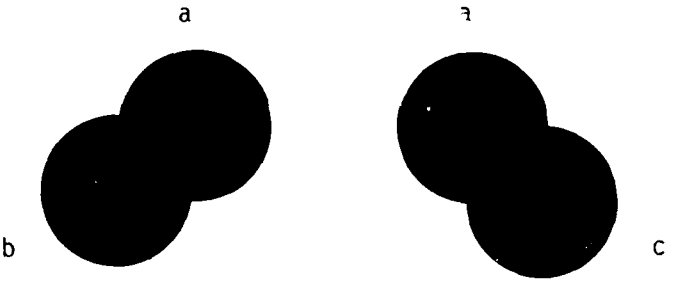
(a) (b) (c)
RADAR CAMOUFLAGE OR (RADAR AND CAMOUFLAGE)



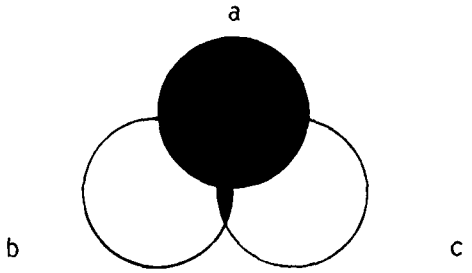

The "AND" opertation is done before the "OR" operation.

To achieve the same results using DROLS logic the descriptor must be combined with each of the free text term by a Boolean "OR".

(a) (b) (a) (c)
RADAR CAMOUFLAGE OR RADAR AND RADAR CAMOUFLAGE OR CAMOUFLAGE




Combined




The or operations are done first, and then the results are combined.

Once the three types of search strategies (descriptor, free text, and combined) were constructed, they were run against the three management data bases and statistics were collected. For purposes of this paper, discussion of the results will be generally limited to the Work Unit Information System. The Work Unit system is the largest of the management data bases and it is felt to be representative of the others.

The test searches were run periodically between April 22 and June 23, 1981 in order to test free text searching during a variety of conditions. The chart in appendix C gives a listing of Work Unit search dates and under what conditions the tests were conducted.

## RESULTS

### HOW MUCH LARGER WILL THE MANAGEMENT DATA BASE INVERTED FILES BE?

The following table lists the number of disk tracks that the managment data bases occupied prior to the implementation of free text searching and the number they now occupy. It should be noted that file updates may have occured during the test period and could have an effect on the file size.

INVERTED FILE SIZES

| | March 25, 1981 (before text inversion) | June 24, 1981 (after text inversion) | *Projection |
|---|---|---|---|
| Work Unit | 6,399 | 13,969 | 12,399 |
| Program Planning | 1,151 | 3,968 | 2,301 |
| Independent Research | 1,555 | 4,736 | 2,905 |
| Totals | 9,105 | 22,400 | 17,605 |

Number of tracks per disk pack are approximately 19,000.

The new inverted files are much larger than the previous ones. For comparison, the old files resided on 9,105 disk tracks or less than half a disk pack and the new free text files reside on 22,400 disk tracks or just over one disk pack. Projections had been made for the management data base file sizes in January 1981 based on the Technical Reports experimentation. (See appendix D.) These estimates were just under the actual implementation inverted file sizes. The narrative portions of the management data bases are slightly longer than the technical report title and abstract; consequently, their estimated file sizes were a little conservative.

* Projection based on Technical Reports experiment. See appendix D.

HOW WILL COMPUTER RESPONSE TIME BE AFFECTED WITH THE LARGER INVERTED FILES?

Each of the 29 Work Unit Information System test searches was run 15 times under a variety of conditions. For each search the computer time was noted. (See appendix E.)

Each run of the searches was characterized by two parameters - type of search (combined, descriptor, or free text) and the operating condition under which the search was conducted (normal search in the online system with normal searching background prior to free text inversion = N, test system search in the test online system with a two terminal searching background and the free text terms were included = T, or normal search in the online system with normal searching background and free text terms were included = P). The computer times are cumulated and averaged at the bottom of the chart. The cumulated times are graphed for comparison in appendix f. It was expected that the Test (T) searches would take less time than the Production (P) searches. The online system was handling a normal workload during the production phase and only one or two terminals during the test phase of implementation. (For search dates refer to appendix c.) The run labeled "RUS", to the far right in appendix E, is an extra free text run that had a date range added to limit the search results. It has been included here to show how an additional boolean operator can add to the computer time.

The conclusion that can be drawn from appendix F is that it takes significantly more computer time to search with free text terms. There are several reasons for the longer time:

a. There are more documents retrieved; therefore, the computer has more information to manipulate. (The next section will explore this in more detail.)

b. In free text searching, a number of boolean operators must be used to equate a single level search or a multi-word descriptor. Combining two free text words will take the computer longer to perform than the table look up for a descriptor.

c. The masking or truncation capability is used more frequently in free text searching and requires more computer time.

d. For a comprehensive search the descriptors must be added on each boolean level. This requires additional time for the computer to merge the results.

WILL THE NUMBER OF RECORDS RETRIEVED BE SIGNIFICANTLY LARGER?

As each test search was completed the number of documents retrieved was noted. (See appendix G.) The structure of the chart is the same as described above in the computer response time section. The number of documents retrieved per search run are graphed for comparison in appendix H. The slight variation among groups is due to file updates. As can be seen in the graph, free text searching gives over a 100 percent increase in recall for the combined searches.

HOW WILL RELEVANCE OF RETRIEVAL USING FREE TEXT BE AFFECTED?

To gather documents for relevance review, a free text search was conducted with a date range added to limit search results. These searches are labled "RUS" on the previous charts. The results were ordered for 20 searches and ten documents of each were examined for relevance.

There are many problems with using relevance as an evaluation criteria. Relevance judgments are subjective and therefore people will disagree. Many authors have faced this problem and Donald W. King addressed it in the 1968 Annual Review of Information Science & Technology.

> The reports also reveal the hazards of using relevance assessments blindly. The prescriptions are given for avoiding such pitfalls, however, and one must conclude that since relevance is a concept that cannot be avoided, it must be used. However, it is comforting to know that one can now properly feel nervous in using it.[5]

For purposes of this study documents were judged in one of three categories, relevant, marginally relevant, or not relevant, based on the following criteria.

A. Documents which could relate to the topic directly or from which the answer could be inferred.

B. Documents which directly related to the topic.

C. Documents which contained ideas or facts that could be useful in considering the topic.

The subject, the document numbers, and relevance standing for each of the twenty searches are listed in appendix I. In addition, the documents are noted under the column labeled "match" if it would have fallen in a descriptor search. The results are summarized under comments.

The free text relevance judgements are plotted in appendix J for comparison. The first column represents the cumulative total of the 200 documents reviewed. If the 20 searches had been conducted by descriptors alone only 23 percent of the documents would have been retrieved.

---

5. D.W. King, "Design & Evaluation of Information Systems" in Annual Review of Information Science & Technology, vol. 3, C. Cuadra, ed., (Chicago: Encyclopaedia Britannica, 1968), pp. 61-103.

The more important question of relevance is plotted in the next three columns. For the 200 documents retrieved: 56.5 percent were judged relevant, 26.5 percent were judged marginally relevant, and 17 percent were judged not relevant. Descriptor recall, for the 200 test documents, is plotted on top of the free text results. For the documents judged to be relevant only 20 percent would have been retrieved using descriptors only. It should be noted that the high rate of false drops in the not relevant column was for the most part due to search construction problems. Searcher experience can significantly reduce the false drop rate.

## CONCLUSIONS

Free text searching has been very successful in the DROLS management data bases. It had been feared that the much larger inverted files would seriously affect response time. In appendix E, the search labeled "WHI" was run after free text had been implemented in all the management data bases, and the new feature had been made available to the entire online community. The response time for this search, as compared to the other combined searches, took no longer. The background of larger inverted files and normal use seems to have little effect on the computer response time. While a combined search takes longer than a descriptor search, it makes very little difference to the user who does not wish to retrieve free text terms.

The primary advantage of using free text searching is access to relevant documents that have been previously impossible or difficult to locate. As searchers gain experience in the use of free text searching, results can be limited to a much more relevant set of documents than has been possible. This study did not use the string searching (text search) capability that has been available to DROLS users for some time, however, the combination of free text inverted file searching and string searching of the direct file can greatly narrow results to a few highly relevant documents. It should be noted that some relevant documents may be missed using the combined methods, because authors may not use the precise phrases the searcher selects.

## RECOMMENDATIONS

It is recommended:

That the free text searching capability be maintained in the management data bases after the six month trial period.

That the user community be carefully trained to take advantage of the benefits and to avoid the pitfalls of free text searching.

That the free text searching capablilty be expanded to the Technical Reports Data Base if the mass storage is available.

ACKNOWLEDGEMENTS

A special note of thanks to the individuals who helped implement and test free text searching: Charles D. Edmondson, Robin P. Gates and John L. Maguire.

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Lancaster, F.W. and Fayen, E.B., Information Retrieval On-Line, Los Angeles, California: John Wiley & Sons, Inc., 1973.

Lancaster, F.W., Information Retrieval Systems, New York: John Wiley & Sons, Inc., 1979.

U.S., Department of Defense, Defense Technical Information Center, DTIC Retrieval and Indexing Terminology: Posting Terms with Hierarchy and KWOC (AD-A068-500), May 1979.

Appendix A

## TEXT WORD SEARCHING IN THE MANAGEMENT DATA BASES

### INTRODUCTION

The Text Word Searching capability allows the user to directly search for those records in the management data base inverted files containing specific words or phrases.

### VOCABULARY

1. All single words from the title and narrative fields are posted to the inverted file (except stop words). All the words following the example narrative will be posted to the inverted file.

EXAMPLE:

This paper proposed a waveform-agile radar, analyzes the signal-processing required, and describes the state of the art of two new acusto-electric devices needed for the agile radar: the memory correlator (Model R-10), which provides electronically programmable matched filtering of individual pulses, and the coherent integrator, which is being developed to provide electronically programmable doppler processing. The electronic programmability of these compact wideband analog devices gives them unique functional capabilities which may allow future tactical systems to achieve electronic counter measure resistance and low probability of intercept by facilitating the use of continually changing wideband waveforms.

| | | |
|---|---|---|
| 10 | electronic | processing |
| achieve | electronically | programmability |
| acusto | facilitating | programmable |
| agile | filtering | proposes |
| allow | functional | pulses |
| analog | future | r |
| analyzes | gives | radar |
| art | individual | resistance |
| capabilities | integrator | signal |
| changing | intercept | state |
| coherent | low | systems |
| compact | matched | tactical |
| continually | measure | them |
| correlator | memory | two |
| counter | model | unique |
| developed | needed | waveform |
| devices | new | waveforms |
| doppler | paper | wideband |
| electric | probability | |

2. All stop words are deleted from the narrative. Attachment 1 is the stop word list composed and used by DTIC.

3. Text words allow the searcher to find highly relevant summaries if used properly. Do not search text words for dogs or dog if you are looking for summaries on German Shepherds. Use the specific terminology German and Shepherds.

4. Highly posted terms should never be used as the first search term in your search strategy. Helicopters and Design is more efficient than Design and Helicopters because design is a very highly posted term and the computer has fewer items to examine if the smaller term Helicopters is used first.

5. When using the text searching capability, some terms may result in finds of more than the 25,000 limit. Use of accession number ranging would eliminate the problem of an incomplete search.

TEXT WORD SEARCH STRATEGY FORMULATION

1. Text words are searched using role code 60. Text words will be excluded in normal subject searches.

EXAMPLE:

TELECOMMUNICATIONS will retrieve everything but text words

?60TELECOMMUNICATIONS will retrieve only text words

2. The maximum length of a text word search term is 60 characters.

3. Text words may be truncated to pick up any words with the same word root. This option should be used carefully to guard against too many false finds.

EXAMPLE:

?60%DOG will retrieve dog and dogs along with dogmatic, dogma, etc.

4. Blanks and special characters are term separators. All special characters are treated as blanks. There are no exceptions.

EXAMPLES:

| Narrative Phrase | Search Terms |
|---|---|
| 2, 4-D | 2 and 4 and D |
| AN/800-1 | 800 and 1 (AN is a stop word) |
| F-15 | F and 15 |
| TF30-P-3 | TF30 and P and 3 |
| Cobalt-Alloyed Silicon | Cobalt and Alloyed and Silicon |
| 1,000 Ton Trucks | 1 and 000 and Ton and Trucks |

5. Alphanumerics, Chemical Terminology, and Proper Names can be searched as text words.

EXAMPLES:

Alphanumerics - M-16, F-16, 45mm (The dash is a special character and is treated as a blank.)

Chemical Terminology - Tetracycline, Acetylsalicylic Acid, H2SO4 (See Verbalizing for Machinability Rules, Attachment 2.)

Proper Names - Laplace Transform, Einstein Equations, Hodgkins Disease (When used in the search- Laplace and Transform, Einstein and Equations, Hodgkins and Disease.)

6. Variant spellings and word forms should be considered during search strategy formulation.

EXAMPLES:

Spellings - Color, Colour, Programmer, Programer

Forms - Mine, Mines, Mined, Mining

7. Synonyms should be considered during search strategy formulation.

EXAMPLE:

Marijuana, Marihuana, Pot, Grass, Weed, Mary Jane

8. Foreign spellings should be considered during search strategy formulation.

EXAMPLE:

Radiatsii (Russian), Radiation (French), Strahlung (German), Strating (Dutch)

9. Common misspellings should be considered during a comprehensive search strategy formulation.

EXAMPLE:

Retrieval, Retreival

10. Text word searching may be used in conjunction with Text Title and Narrative searching. The text word search narrows the search to summaries which contain the specific words to be searched.

EXAMPLE: A search for summaries on Solar Collectors

Inverted File Search for Specific Terms

| | |
|---|---|
| @SWU@ | - Data Base Command |
| ?60SOLAR | - Text Word Role Code and Term |
| AND | - Boolean operator |
| ?60COLLECTOR | - Text Word Role Code and Term |
| ?60COLLECTORS | - Text Word Role Code and Term |
| END | - Search terminator |

Text Search (Qualification)

| | |
|---|---|
| @SRTAB@ | - Scan Title and Narrative Command |
| SOLAR COLLECTOR | - Text string to be searched. |
| SOLAR COLLECTORS | - Text string to be searched. |
| END | - Search terminator |

To display the results, use the Display Qualified Results Command, @DQR@.

# VERBALIZING FOR MACHINABILITY

The following symbols may be used in abstracts, annotations and titles:

. , : ; ' / * $ % ( ) - + = < > & ?

↓ ↓ ↓ ↓ ↑ ↓ ↑ ↑ ↑ ↑↑ ↓ ↑ ↑ ↑ ↑ ↑ ↑

(Arrows indicate upper and lower shift characters.)

The following symbols may be used in indexing terms:

. / ( ) -

## ACCENTS/DIACRITICAL MARKS

Omit except in the following cases:

ä *is replaced by* ae
ö *is replaced by* oe
ü *is replaced by* ue
ϕ *is replaced by* oe
} *Germanic languages*

## ANGSTROM UNITS (Å)

*Use* A

## CHEMICALS

$H_2SO_4$ *use* H2SO4
-> *use* yields

*See also* PRIMES, SUBSCRIPTS, SUPERSCRIPTS

## CUBIC

$cm^3$ *use* cu cm *or* cc
$ft^3$ *use* cu ft
$m^3$ *use* cu m

$\frac{1}{x^3}$ or $x^{-3}$ } *use* 1/(x cubed)

*See also* EXPONENTS

## DEGREES

*Angles:* 60° 30'15" *use* 60 deg 30 min 15 sec
*Latitude/Longitude:* *Add N, S, E, or W at end of expression.*
60° 30'15" N *use* 60 deg 30 min 15 sec N
*Temperautre:* 60° C *use* 60 C
60° F *use* 60 F
60° K *use* 60 K

## DIACRITICAL MARKS

*See* ACCENTS/DIACRITICAL MARKS

## EXPONENTS

$x^{(n-1)}$ *use* x to the (n-1) power
$ft\ sec^{-1}$ *use* ft/sec
*When the exponent is less than 7 and has the base 10, write out the number; e.g.,*
$10^2$ *use* 100
$10^{-4}$ *use* 0.0001
$2.75 \times 10^{-3}$ *use* 0.00275
*When the base is 10 and the exponent is 7 or more, write out; e.g.,*
$10^7$ *use* 10 to the 7th power
$10^{-9}$ *use* 10 to the minus 9th power

*See also* CUBIC, SQUARE, SUPERSCRIPTS

## FRACTIONS

*Use the slash (virgule) for the fraction bar; e.g.,*

$x=\frac{a-b}{c}$ *use* x=(a-b)/c

$x=a-\frac{b}{c}$ *use* x=a-(b/c)

## GREATER THAN OR EQUAL TO ( ≥ )

*Use* > or =

## GREEK LETTERS

*Use their names; e.g.,*

α *use* alpha
β *use* beta
μ *use* mu, micro, *or* micron *as applicable*
π *use* pi

*See also* SPECIAL SYMBOLS

## ITALICS

*Do not use; see also* UNDERSCORING

## LESS THAN OR EQUAL TO ( ≤ )

*Use* < or =

## LOGARITHMS

$\log_{10}$ *use* log
$\log_e$ *use* ln *(alpha "l" not digit "1")*

## MICRO- or MICROMICRO-

μl *use* microliters
μs *use* microsecs
μv *use* microvolts
μμf *use* micromicrofarads *or* picofarads

## MICRONS

μ *use* micron(s) *when applicable*
mμ *use* millimicron(s)
μm *use* micrometer(s) *or* micron(s)
μμ *use* micromicron(s) *or* picometer(s)
um *use* micrometer(s) or micron(s) *when applicable*

## PLUS OR MINUS ( ± )

*Use* + or –

## PRIMES (')

*Use repeating apostrophe*

2,2',2" -terpyridyl *use* 2,2',2" -terpyridyl
a'" ( a triple prime) *use* a' ' '

## QUOTATION MARKS (")

*Use the apostrophe or single quote only.*

*Where quotation marks are conventionally used as a symbol, abbreviate; e.g.,*

12" *use* 12 in.

5"/54 cal guns *use* 5-in./54-cal guns

45" *use* 45 sec

*See also* DEGREES, PRIMES

## SPECIAL SYMBOLS

≅ ≈ } *use* approx. =

→ { *use* yields *(chemistry)*
*use* approaches limit of *(mathematics)*

$\vec{K}$ *use* K

# *use* number

∞ *use* infinity

λ { *use* wavelength *(electronics and physics)*
*use* lambda *(all other)*

Ω { *use* ohm *(electricity and electronics)*
*use* omega *(all other)*

Φ { *use* phase *(electricity and electronics)*
*use* phi *(all other)*

*Similarly, spell out or show by acceptable alphanumeric characters* increment, varies as, therefore, differential of, variation of, integral, sum, benzene ring, thunderstorm, male, female, fixed star, *etc.*

## SQUARE

$cm^2$ *use* sq cm

$ft^2$ *use* sq ft

$m^2$ *use* sq m

$I_x^2$ $I_{x^2}$ } *use* $I_x$ (x squared)

*See also* EXPONENTS

## SQUARE ROOT

$\sqrt{a-b}$ $(a-b)^{1/2}$ } *use* square root of (a-b)

## SUBSCRIPTS

$P_H$ *use* P sub H

$V_2$ *use* V sub 2

$B_5$ *use* B *(omit the 5, which is the atomic number of boron)*

$C_{14}$ *use* C14 *if it is the isotope of carbon*

*See also* CHEMICALS, SUPERSCRIPTS

## SUPERSCRIPTS

$^{14}C$ *use* C14

$H^+$ *use* H(+)

$SO_4^{--}$ *use* SO4(--)

$V^{5+}$ *use* V(5+)

$U^{234}$ *use* U234

$B^{10}$ *use* B10

$O^{18}(p,n)N^{15}$ *use* O18(p,n)N15

$d_{23}^{25}$ *use* density at 23 deg F referred to water at 25 deg F

$n_D^{20}$ *use* index of refraction for 20 deg F and sodium light

*See also* CUBIC, EXPONENTS, SQUARE

## UMLAUT see ACCENT

## UNDERSCORING

*Do not use underscoring.*

Escherichia coli *use* Escherichia coli

quasar *use* quasar

## Appendix B

## STOP WORD LIST

A
AFTER
ALSO
AN
AND
ANY
ARE
AS
AT
AUTHOR
AVAILABLE

BE
BEEN
BEING
BETWEEN
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BUT
BY

C
CAN
CFRD
CONDUCTED
CONSIDERED
COULD
CRD

DESCRIBED
DESCRIBES
DESIGNED
DETERMINE
DETERMINED
DIFFERENT
DISCUSSED
DUE
DURING

EACH

FOR
FOUND
FROM
FURTHER

GENERAL
GIVEN

HAS
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HOWEVER

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IN
INCLUDED
INTO
INVESTIGATED
IS
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ITS

MADE
MAY
MORE
MOST

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OBTAINED
OF
ON
ONLY
OR
OTHER
OUT

PERFORMED
POSSIBLE
PRESENT
PRESENTED
PRESENTS
PROVIDE
PROVIDED
PROVIDES

RELATED
REPORT
REQUIRED
RESULTS

S
SEE
SELECTED
SEVERAL
SFRD
SHOULD
SHOWN
SIGNIFICANT
SOME
SRD
STUDIES
SUCH

TESTED
THAN
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THE
THEIR
THERE
THESE
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THOSE
THROUGH
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TYPES

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VARIOUS
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WAS
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WHERE
WHICH
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WILL
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WITHIN
WITHOUT
WOULD

Appendix C

## SEARCH HISTORY

| Search Date | Color Code | Version |
|---|---|---|
| April 22, 1981 | Orange | Normal |
| | Purple | Normal |
| April 29, 1981 | Red | Test |
| | Yellow | Test |
| | Green | Test |
| | Avocado | Test |
| | Black | Test |
| | Brown | Test |
| May 13, 1981 | Pink | Production |
| | Light Blue | Production |
| | Silver | Production |
| | Rust | Production |
| May 14, 1981 | Peach | Production |
| | Lavender | Production |
| | Green/brown | Production |
| Jun 23, 1981 | White | Production |

Normal = Online search prior to free text implementation.

Test = Test online system without normal user background.

Production = Online search after free text implementation with normal user background.

Appendix D

January 1981

TEXT WORD INVERTED FILE SIZE PROJECTIONS

About 15,000,000 words or the TR file were processed. This generated an inverted file of 3,960 tracks (containing only text words). The following predictions are made for DTIC data bases based on the TR sample.

| | |
|---|---|
| TR | +27,000 tracks |
| WUIS | + 6,000 tracks |
| RDPP | + 1,150 tracks |
| IRD | + 1,350 tracks |

Note: One disk drive contains about 19,000 tracks.
These figures are based on data collected during the summer of 1980.

Appendix E

COMPUTER TIME

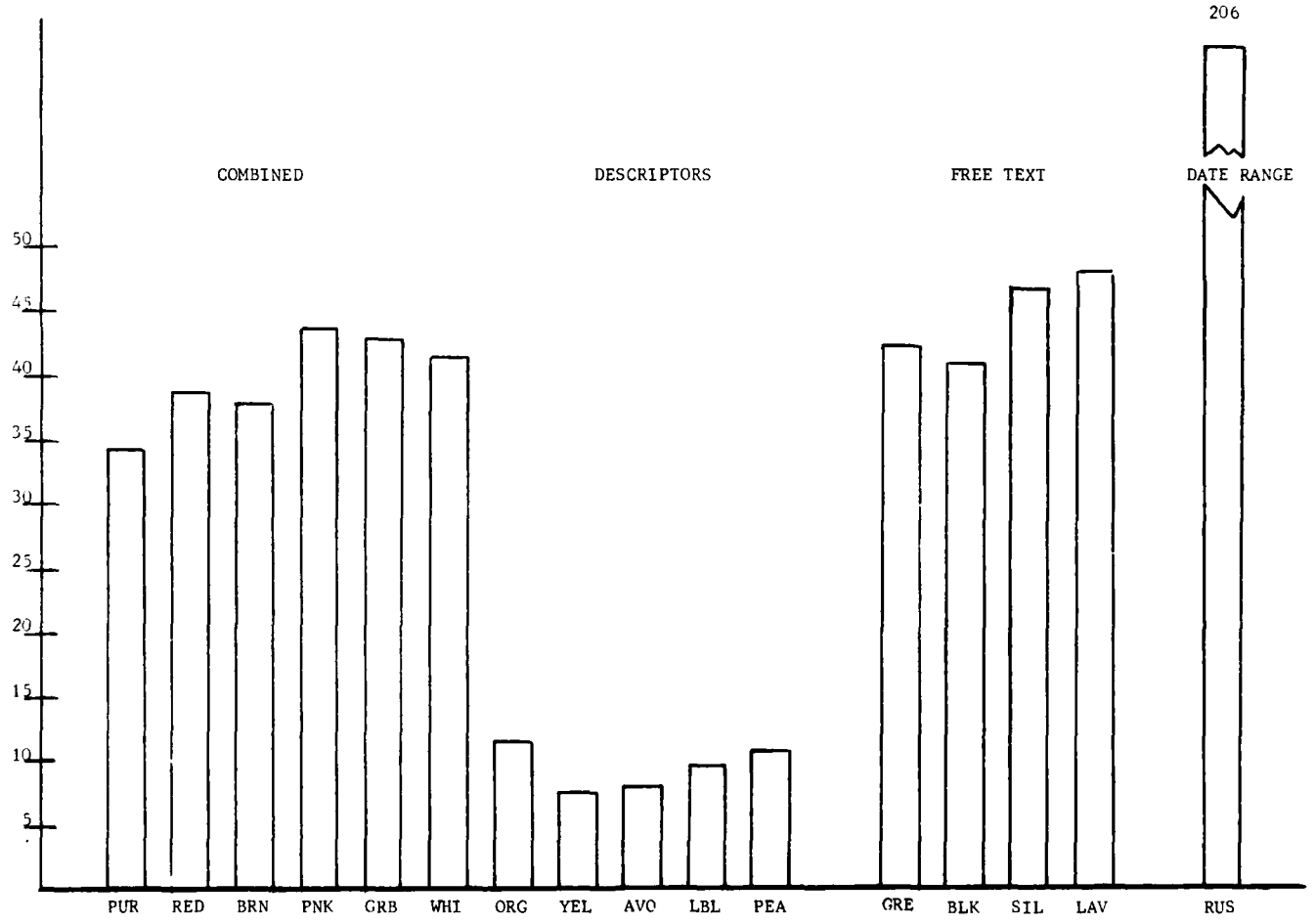
| | COMBINED | | | | | | DESCRIPTORS | | | | | FREE TEXT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | T | T | P | P | P | N | T | T | P | P | T | T | P | P | P |
| (color code) | PUR | RED | BRN | PNK | GRB | WHI | ORG | YEL | AVO | LBL | PEA | GRE | BLK | SIL | LAV | RUS |
| B BAND | 2.8 | 3.4 | 3.3 | 3.4 | 3.6 | 3.6 | .3 | .2 | .2 | .2 | .5 | 3.1 | 3.0 | 3.1 | 7.8 | 8.3 |
| CHROMATOGRAPHIC ANALYSES | 1.7 | 2.5 | 2.1 | 2.1 | 2.1 | 2.2 | .2 | .2 | .2 | .2 | .2 | 1.9 | 1.9 | 2.0 | 2.0 | 7.2 |
| GAMMA RAY SCATTERING | 1.3 | .8 | .9 | 1.1 | 1.2 | 1.0 | .2 | .2 | .2 | .2 | .5 | 1.8 | 1.8 | 2.3 | 2.0 | 7.9 |
| NAVAL PERSONNEL | 1.4 | 1.9 | 1.9 | 2.0 | 1.9 | 2.0 | .5 | .4 | .5 | 1.1 | .5 | 1.4 | 1.5 | 1.6 | 1.7 | 7.4 |
| SOLAR DISTURBANCES | .8 | .5 | .5 | .7 | .7 | .8 | .3 | .2 | .2 | .2 | .5 | .7 | .5 | .6 | .7 | 5.9 |
| ARMY AIRCRAFT | 1.1 | 2.8 | 2.0 | 2.2 | 2.4 | 2.1 | .3 | .2 | .2 | .2 | .7 | 1.7 | 1.8 | 2.0 | 1.9 | 7.8 |
| RADAR CAMOUFLAGE | 1.0 | .9 | .9 | 1.0 | .9 | 1.0 | .4 | .2 | .2 | .2 | .3 | .7 | .7 | .8 | .8 | 6.2 |
| F-15 | 1.0 | 2.6 | 2.6 | 2.2 | 2.1 | 2.2 | .7 | .5 | .5 | .3 | .4 | 1.5 | 1.6 | 1.6 | 1.5 | 7.1 |
| AIR FILTERS | .8 | 1.8 | 1.8 | 2.1 | 2.0 | 1.8 | .5 | .2 | .2 | .2 | .2 | 4.4 | 3.9 | 4.6 | 4.2 | 12.2 |
| AIR TO SURFACE AND MISSILES | 1.2 | 5.5 | 6.1 | 6.9 | 6.3 | 6.5 | .4 | .4 | .6 | .6 | .5 | 6.6 | 5.7 | 7.7 | 5.7 | 19.1 |
| YAWMETERS | .3 | .3 | .2 | .3 | .3 | .2 | .3 | .2 | .2 | .3 | .3 | .2 | .2 | .4 | .2 | --- |
| COLDWEATHER AND CLOTH | 1.1 | .9 | .8 | .9 | .8 | .9 | .4 | .3 | .3 | .4 | .4 | .6 | .6 | .8 | .6 | 6.2 |
| SALT WATER | 1.5 | .7 | .7 | 1.1 | 1.0 | .8 | .5 | .2 | .2 | .2 | .3 | .6 | .6 | 1.1 | .7 | 6.7 |
| UNDERWATER NAVIGATION | .9 | .7 | .7 | .8 | 1.0 | .7 | .2 | .2 | .2 | .3 | .3 | .6 | .5 | .6 | .6 | 3.8 |
| TWO DIMENSIONAL FLOW | 2.6 | 2.7 | 2.8 | 2.9 | 2.9 | 2.9 | .2 | .2 | .1 | .2 | .5 | 2.2 | 2.2 | 2.2 | 2.1 | 7.5 |
| ARTIFICIAL INTELLIGENCE | 1.2 | .7 | .7 | .9 | .8 | .9 | .5 | .4 | .4 | .4 | .6 | .5 | .5 | .5 | .5 | 6.0 |
| SUPERCONDUCT AND THIN FILMS | 2.7 | 2.2 | 2.3 | 3.7 | 2.4 | 2.5 | 1.0 | .5 | .6 | .6 | 1.1 | 1.4 | 1.4 | 1.5 | 1.5 | 6.7 |
| PACKET AND SWITCHING | .9 | .8 | .9 | 1.2 | 1.9 | 1.0 | .4 | .5 | .5 | .6 | .6 | .5 | .5 | .6 | .7 | 5.6 |
| AERODYNAMIC CONFIGURATIONS | 1.0 | 1.0 | 1.0 | 1.1 | 1.1 | 1.1 | .3 | .2 | .3 | .3 | .3 | 1.3 | 1.3 | 1.3 | 1.3 | 6.9 |
| FUEL TANKS | .7 | .7 | .6 | .7 | 1.0 | .6 | .2 | .2 | .2 | .2 | .2 | 1.6 | 1.5 | 1.6 | 1.5 | 6.8 |
| ULTRASONIC WELDING | 1.3 | .4 | .3 | .6 | .5 | .4 | .2 | .2 | .2 | .3 | .2 | .3 | .3 | .4 | .4 | 5.5 |
| TURBOCHARGERS | .4 | .2 | .2 | .2 | .2 | .2 | .2 | .1 | .2 | .2 | .2 | .1 | .2 | .2 | .6 | 7.6 |
| SONAR SIGNALS | .7 | .8 | .8 | .9 | .8 | .9 | .4 | .2 | .2 | .2 | .8 | 2.5 | 2.5 | 2.6 | 2.6 | 8.4 |
| RESURPINE | .3 | .2 | .3 | .3 | .6 | .3 | .5 | .1 | .2 | .3 | .4 | .2 | .2 | .2 | .3 | 6.1 |
| SULFURIC ACID | .9 | .5 | .5 | .5 | .4 | .5 | .9 | .2 | .2 | .2 | .2 | .4 | .4 | .4 | .6 | 5.9 |
| PHOTOSENSITIVITY | .4 | .3 | .2 | .5 | .3 | .5 | .2 | .1 | .2 | .3 | .2 | .2 | .2 | .4 | .3 | 5.5 |
| AUTOMATIC WEAPONS | 1.7 | .9 | .9 | 1.1 | 1.3 | 1.0 | .5 | .2 | .2 | .2 | .2 | 3.6 | 3.7 | 3.7 | 3.6 | 8.9 |
| FUEL CONSUMPTION | 1.0 | .6 | .7 | .7 | .6 | .9 | .2 | .2 | .2 | .3 | .2 | .5 | .4 | .6 | .5 | 6.3 |
| CHEMICAL WARFARE | .9 | 1.0 | 1.0 | 1.2 | 1.1 | 1.5 | .3 | .4 | .2 | .3 | .2 | .8 | .9 | 1.0 | .9 | 6.4 |
| TOTAL | 33.6 | 38.3 | 37.7 | 43.3 | 42.2 | 41.0 | 11.2 | 7.3 | 7.8 | 9.2 | 11.5 | 41.9 | 40.5 | 46.4 | 47.8 | 205.9 |
| AVERAGE | 1.158 | 1.320 | 1.300 | 1.493 (*) | 1.455 (*) | 1.413 (*) | .386 | .251 | .268 | .317 (*) | .396 (*) | 1.444 | 1.396 | 1.600 (*) | 1.648 (*) | 7.100 (**) |

N = Normal online search prior to free text
T = Test system search with free text terms
P = Normal online search with free text terms

* = Updated file
** = Date range added

Appendix F

CUMULATIVE COMPUTER TIME PER SEARCH RUN



Appendix G

NUMBER OF HITS

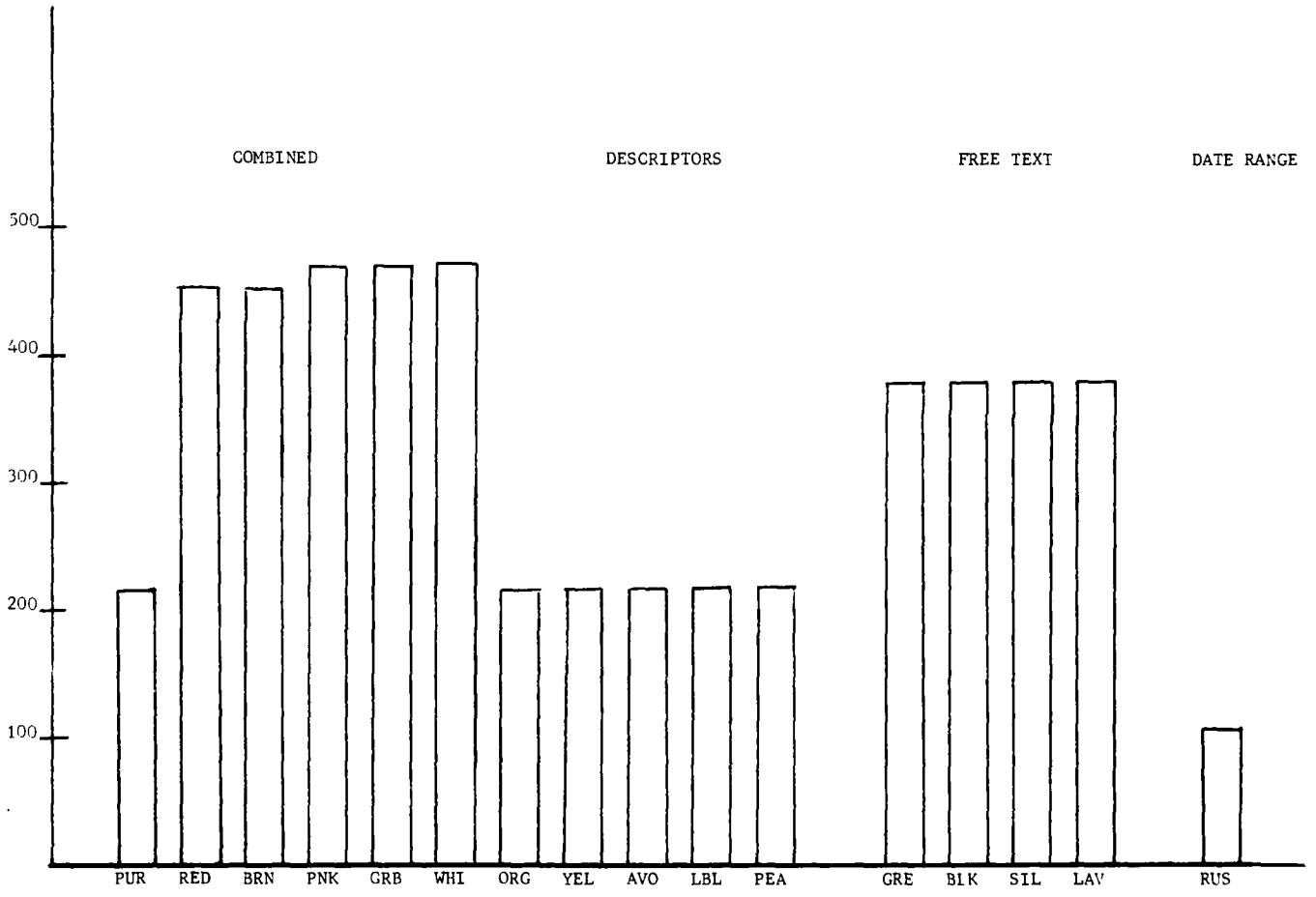
| | COMBINED | | | | | | DESCRIPTORS | | | | | FREE TEXT | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | T | T | P | P | P | N | T | T | P | P | T | T | P | P | P |
| (color code) | PUR | RED | BRN | PNK | GRB | WHI | ORG | YEL | AVO | LBL | PEA | GRE | BLK | SIL | LAV | RUS |
| B BAND | 2 | 413 | 413 | 414 | 414 | 413 | 2 | 2 | 2 | 2 | 2 | 413 | 413 | 414 | 414 | 120 |
| CHROMATOGRAPHIC ANALYSES | 263 | 373 | 375 | 375 | 375 | 374 | 263 | 263 | 263 | 263 | 263 | 151 | 151 | 151 | 151 | 39 |
| GAMMA RAY SCATTERING | 22 | 64 | 64 | 64 | 64 | 65 | 22 | 22 | 22 | 22 | 22 | 81 | 81 | 81 | 81 | 6 |
| NAVAL PERSONNEL | 1964 | 3083 | 3083 | 3089 | 3089 | 3088 | 1964 | 1964 | 1964 | 1968 | 1968 | 1671 | 1671 | 1675 | 1675 | 414 |
| SOLAR DISTURBANCES | 134 | 274 | 274 | 274 | 274 | 274 | 134 | 134 | 134 | 134 | 134 | 224 | 224 | 224 | 224 | 58 |
| ARMY AIRCRAFT | 694 | 1614 | 1614 | 1615 | 1615 | 1622 | 694 | 694 | 694 | 695 | 695 | 1382 | 1382 | 1383 | 1383 | 324 |
| RADAR CAMOUFLAGE | 48 | 48 | 48 | 107 | 107 | 107 | 48 | 48 | 48 | 48 | 48 | 76 | 76 | 76 | 76 | 26 |
| F-15 | 129 | 1042 | 1042 | 1043 | 1043 | 1043 | 129 | 129 | 129 | 127 | 127 | 1022 | 1022 | 1024 | 1024 | 308 |
| AIR FILTERS | 47 | 290 | 290 | 290 | 290 | 293 | 47 | 47 | 47 | 47 | 47 | 649 | 649 | 647 | 647 | 213 |
| AIR TO SURFACE AND MISSILES | 11 | 761 | 1105 | 1105 | 1105 | 1105 | 11 | 11 | 11 | 11 | 11 | 1060 | 1060 | 1058 | 1058 | 347 |
| YAWMETERS | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | --- |
| COLDWEATHER AND CLOTH | 8 | 28 | 28 | 28 | 28 | 29 | 8 | 8 | 8 | 8 | 8 | 19 | 19 | 19 | 19 | 4 |
| SALT WATER | 58 | 298 | 298 | 298 | 298 | 301 | 58 | 58 | 58 | 58 | 58 | 274 | 274 | 274 | 274 | 57 |
| UNDERWATER NAVIGATION | 111 | 155 | 155 | 155 | 155 | 154 | 111 | 111 | 111 | 111 | 111 | 64 | 64 | 64 | 64 | 10 |
| TWO DIMENSIONAL FLOW | 238 | 746 | 746 | 746 | 746 | 747 | 238 | 238 | 238 | 238 | 238 | 621 | 621 | 621 | 621 | 195 |
| ARTIFICIAL INTELLIGENCE | 5 | 23 | 23 | 24 | 24 | 24 | 5 | 5 | 5 | 6 | 6 | 15 | 15 | 15 | 15 | 9 |
| SUPERCONDUCT AND THIN FILMS | 76 | 155 | 155 | 155 | 155 | 157 | 76 | 76 | 76 | 76 | 76 | 134 | 134 | 134 | 134 | 27 |
| PACKET AND SWITCHING | 8 | 28 | 28 | 28 | 28 | 28 | 8 | 8 | 8 | 8 | 8 | 22 | 22 | 22 | 22 | 11 |
| AERODYN[illegible] CONFIGURATIONS | 792 | 1191 | 1191 | 1193 | 1193 | 1193 | 792 | 792 | 792 | 792 | 792 | 877 | 877 | 879 | 879 | 232 |
| FUEL TA[illegible] | 340 | 469 | 469 | 471 | 471 | 474 | 340 | 340 | 340 | 340 | 340 | 546 | 546 | 546 | 546 | 196 |
| ULTRASONIC WELDING | 11 | 22 | 22 | 22 | 22 | 22 | 11 | 11 | 11 | 11 | 11 | 13 | 13 | 13 | 13 | 2 |
| TURBOCHARGERS | 4 | 7 | 7 | 7 | 7 | 7 | 4 | 4 | 4 | 4 | 4 | 9 | 9 | 9 | 9 | 5 |
| SONAR SIGNALS | 514 | 699 | 699 | 699 | 699 | 699 | 514 | 514 | 514 | 514 | 514 | 666 | 666 | 668 | 668 | 154 |
| RESURPINE | 10 | 16 | 16 | 16 | 16 | 16 | 10 | 10 | 10 | 10 | 10 | 12 | 12 | 12 | 12 | 6 |
| SULFURIC ACID | 36 | 90 | 90 | 90 | 90 | 90 | 36 | 36 | 36 | 36 | 36 | 71 | 71 | 71 | 71 | 23 |
| PHOTOSENSITIVITY | 121 | 134 | 134 | 134 | 134 | 134 | 121 | 121 | 121 | 121 | 121 | 22 | 22 | 22 | 22 | 2 |
| AUTOMATIC WEAPONS | 226 | 405 | 405 | 405 | 405 | 407 | 226 | 226 | 226 | 226 | 226 | 461 | 461 | 462 | 462 | 128 |
| FUEL CONSUMPTION | 195 | 293 | 293 | 293 | 293 | 293 | 195 | 195 | 195 | 195 | 195 | 183 | 183 | 183 | 183 | 58 |
| CHEMICAL WARFARE | 246 | 375 | 375 | 382 | 382 | 390 | 246 | 246 | 246 | 252 | 252 | 197 | 197 | 199 | 199 | 40 |
| TOTAL | 6315 | 13098 | 13098 | 13524 | 13524 | 13551 | 6315 | 6315 | 6315 | 6325 | 6325 | 10935 | 10935 | 10946 | 10946 | 3006 |
| AVERAGE | 217 | 451 | 451 | 466 | 466 | 467 | 217 | 217 | 217 | 218 | 218 | 377 | 377 | 377 | 377 | 103 |
| | | | | (*) | (*) | (*) | | | | (*) | (*) | | | (*) | (*) | (** |

N = Normal online search prior to free text
T = Test system search with free text terms
P = Normal online search with free text terms

* = Updated file
** = Date range added

Appendix H

AVERAGE NUMBER OF HITS



APPENDIX I

FREE TEXT RELEVANCE

| B BAND | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DA0E8756 | | | * | | |
| DF091560 | | | * | | 0 = R |
| DF098560 | | | * | | 2 = MR |
| DF102060 | | * | | | 8 = NR |
| DF105090 | | | * | | 0 = Match |
| DF105660 | | | * | | |
| DF106120 | | | * | | Many false drops on this search |
| DF109340 | | | * | | because of paragraph or point |
| DF110380 | | * | | | headers. For example: (b) or B. |
| DF425401 | | | * | | |

| SALT WATER | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DN980143 | | * | | | |
| DA0G2115 | * | | | | 3 = R |
| DA0G6301 | | * | | | 7 = MR |
| DF320620 | | * | | * | 0 = NR |
| DF327510 | | * | | * | 2 = Match |
| DF906950 | | * | | | |
| DN123525 | | * | | | |
| DN594247 | * | | | | |
| DN675229 | | * | | | |
| DN675500 | * | | | | |

| UNDERWATER NAVIGAT: | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DN775448 | | * | | | |
| DN788021 | | * | | | 3 = R |
| DN088001 | * | | | | 4 = MR |
| DN088018 | * | | | * | 3 = NR |
| DN178106 | | * | | | 1 = Match |
| DN188114 | | * | | | |
| DN223696 | | | * | | |
| DN888728 | | | * | | |
| DN989078 | | | * | | |
| DN996404 | * | | | | |

R = Relevant document
MR = Marginally relevant document
NR = Document not relevant (false drop)
Match = Document would have been retrieved by descriptor or open-ended term.

APPENDIX I (cont)

FREE TEXT RELEVANCE

| FUEL TANKS | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DF187070 | | * | | | |
| DF188580 | * | | | | 9 = R |
| DF643510 | * | | | * | 1 = MR |
| DN782488 | * | | | * | 0 = NR |
| DA0B3658 | * | | | | 6 = Match |
| DA0B4016 | * | | | * | |
| DA0D3912 | * | | | * | |
| DA0E3821 | * | | | | |
| DA0G0276 | * | | | * | |
| DA0G0277 | * | | | * | |

| SONAR SIGNALS | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DN675355 | * | | | * | |
| DN775335 | * | | | | 10 = R |
| DN775448 | * | | | | 0 = MR |
| DN888567 | * | | | | 0 = NR |
| DN088009 | * | | | | 3 = Match |
| DN089052 | * | | | | |
| DN136527 | * | | | * | |
| DN223092 | * | | | | |
| DN223873 | * | | | | |
| DN489151 | * | | | * | |

| AIR TO SURFACE MIS: | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DA0Q4521 | * | | | | |
| DF108520 | | | * | | 3 = R |
| DF108980 | | | * | | 1 = MR |
| DF109240 | * | | | | 6 = NR |
| DF109340 | * | | | | 0 = Match |
| DF109600 | | * | | | |
| DF109710 | | | * | | |
| DF110020 | | | * | | |
| DF111170 | | | * | | |
| DF111640 | | | * | | |

R = Relevant document
MR = Marginally relevant document
NR = Document not relevant (false drop)
Match = Document would have been retrieved by descriptor or open-ended term.

APPENDIX I (cont)

FREE TEXT RELEVANCE

| AIR FILTERS | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DF103300 | | | * | | |
| DF107560 | | | * | | 0 = R |
| DF108330 | | | * | | 1 = MR |
| DF115120 | | | * | | 9 = NR |
| DF119580 | | | * | | 0 = Match |
| DF301320 | | * | | | |
| DN220112 | | | * | | |
| DN678752 | | | * | | |
| DN713011 | | | * | | |
| DA0B0758 | | | * | | |

| F-15 | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DF106240 | | * | | | |
| DF110240 | | * | | | 5 = R |
| DF110380 | * | | | | 5 = MR |
| DF110980 | * | | | | 0 = NR |
| DF111130 | | * | | | 0 = Match |
| DF111150 | | * | | | |
| DF111480 | | * | | | |
| DF111610 | * | | | | |
| DF111960 | * | | | | |
| DF112020 | * | | | | |

| RADAR CAMOUFLAGE | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DF101600 | * | | | | |
| DF110900 | * | | | | 6 = R |
| DA0F4817 | | * | | | 4 = MR |
| DA0G0236 | * | | | | 0 = NR |
| DA0G0268 | * | | | | 1 = Match |
| DA0G2484 | | * | | | |
| DA0G4757 | * | | | | |
| DA0G4795 | | * | | | |
| DA0G5166 | * | | | * | |
| DA0G9130 | | * | | | |

R = Relevant document
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NR = Document not relevant (false drop)
Match = Document would have been retrieved by descriptor or open-ended term.

## FREE TEXT RELEVANCE

| CHROMATOGRAPHIC AN: | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DN880254 | * | | | | |
| DA0A6949 | * | | | | 7 = R |
| DA0A7323 | * | | | * | 3 = MR |
| DA0B6242 | * | | | | 0 = NR |
| DA0B6536 | | * | | | 1 = Match |
| DA0B6937 | * | | | | |
| DA0C7456 | | * | | | |
| DA0D9417 | * | | | | |
| DA0E6313 | | * | | | |
| DA0F0088 | * | | | | |

| FUEL CONSUMPTION | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DA0D3220 | * | | | * | |
| DA0D3999 | * | | | * | 9 = R |
| DA0D4101 | * | | | | 1 = MR |
| DA0D4106 | * | | | * | 0 = NR |
| DA0E3812 | * | | | * | 4 = Match |
| DA0E3861 | * | | | | |
| DA0G0501 | * | | | | |
| DA0G1072 | | * | | | |
| DA0G3120 | * | | | | |
| DA0G3375 | * | | | | |

| ARMY AIRCRAFT | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DA0A4996 | * | | | | |
| DA0B0719 | * | | | * | 9 = R |
| DA0B4016 | * | | | * | 1 = MR |
| DA0B6893 | * | | | | 0 = NR |
| DA0C2685 | * | | | | 6 = Match |
| DA0C3427 | * | | | | |
| DA0C3431 | | * | | * | |
| DA0C3439 | * | | | * | |
| DA0C4009 | * | | | * | |
| DA0C6130 | * | | | * | |

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APPENDIX I (cont)

FREE TEXT RELEVANCE

| NAVAL PERSONNEL | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DA0J4338 | * | | | * | |
| DN023002 | * | | | | 10 = R |
| DN023238 | * | | | * | 0 = MR |
| DN023256 | * | | | * | 0 = NR |
| DN063002 | * | | | * | 8 = Match |
| DN075040 | * | | | * | |
| DN075096 | * | | | * | |
| DN075244 | * | | | * | |
| DN075338 | * | | | * | |
| DN075376 | * | | | | |

| AUTOMATIC WEAPONS | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DA0B0700 | * | | | | |
| DA0B0701 | * | | | | 9 = R |
| DA0B0714 | * | | | | 1 = MR |
| DA0B0715 | * | | | | 0 = NR |
| DA0D4922 | | * | | | 0 = Match |
| DA0F1403 | * | | | | |
| DA0G0297 | * | | | | |
| DA0G2427 | * | | | | |
| DA0G5025 | * | | | | |
| DA0G6104 | * | | | | |

| PACKET SWITCHING | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DA0G0858 | * | | | | |
| DA0G8985 | | | * | | 5 = R |
| DA0G9169 | * | | | * | 4 = MR |
| DF051570 | * | | | | 1 = NR |
| DF057420 | | * | | | 1 = Match |
| DF721300 | | * | | | |
| DF724110 | | * | | | |
| DF917470 | | * | | | |
| DN080028 | * | | | | |
| DN680068 | * | | | | |

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APPENDIX I (cont)

FREE TEXT RELEVANCE

| SOLAR DISTURBANCES | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DF046410 | * | | | | |
| DF047370 | * | | | | 7 = R |
| DF053380 | | * | | | 2 = MR |
| DF053770 | * | | | | 1 = NR |
| DF247950 | * | | | * | 3 = Match |
| DF248790 | * | | | | |
| DF248840 | * | | | * | |
| DF249000 | * | | | * | |
| DF249260 | | | * | | |
| DF249650 | | * | | | |

| SULFURIC ACID | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DA0E9105 | | * | | * | |
| DA0E9204 | | * | | | 0 = R |
| DA0G0939 | | * | | * | 9 = MR |
| DA0G4209 | | * | | | 1 = NR |
| DA0G9065 | | * | | | 2 = Match |
| DA0G9095 | | * | | | |
| DA0J7577 | | * | | | |
| DA0Q7892 | | | * | | |
| DF043420 | | * | | | |
| DF180490 | | * | | | |

| AERODYNAMIC CONFIG: | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DF051110 | * | | | | |
| DF057210 | * | | | | 10 = R |
| DF120720 | * | | | | 0 = MR |
| DF138610 | * | | | * | 0 = NR |
| DF139410 | * | | | * | 4 = Match |
| DF139830 | * | | | | |
| DF139870 | * | | | | |
| DF140010 | * | | | * | |
| DF143410 | * | | | | |
| DF143520 | * | | | * | |

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APPENDIX I (cont)

FREE TEXT RELEVANCE

| RESURPINE | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DA0A6427 | | * | | | |
| DA0A7032 | * | | | * | 8 = R |
| DA0A9547 | * | | | | 2 = MR |
| DA0E0086 | | * | | | 0 = NR |
| DA0G6951 | * | | | | 3 = Match |
| DF005720 | * | | | | |
| DF007420 | * | | | * | |
| DF384905 | * | | | | |
| DF386717 | * | | | * | |
| DF388520 | * | | | | |

| TWO DIMENSIONAL FL: | R | MR | NR | MATCH | COMMENTS |
|---|---|---|---|---|---|
| DA0C5002 | | * | | | |
| DA0C5004 | | * | | | 0 = R |
| DA0D3235 | | * | | | 5 = MR |
| DA0D3261 | | | * | | 5 = NR |
| DA0D3999 | | * | | | 1 = Match |
| DA0D8613 | | | * | | |
| DA0D9443 | | | * | | |
| DA0E9013 | | * | | | |
| DA0E9022 | | | * | * | |
| DA0E9040 | | | * | | |

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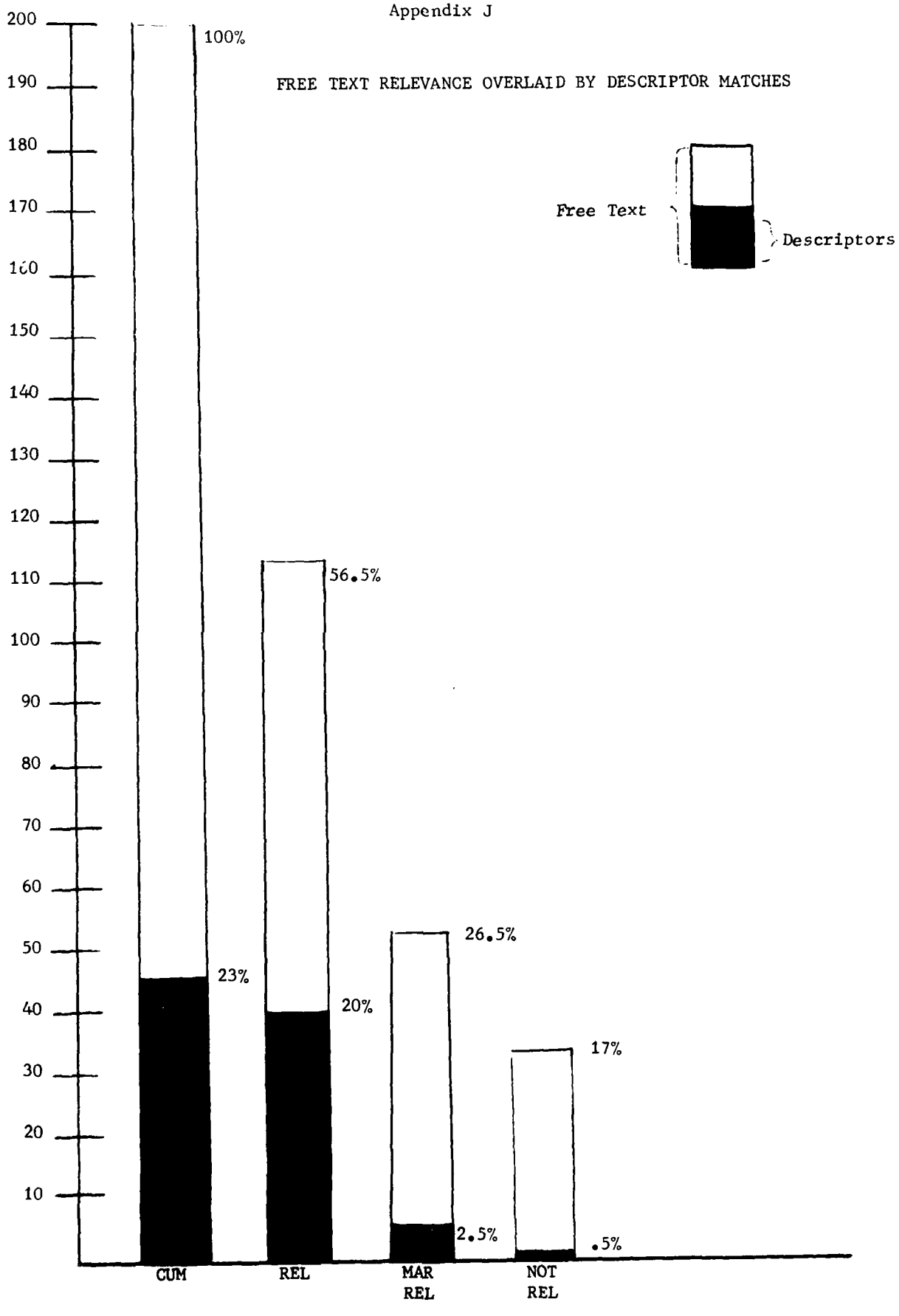
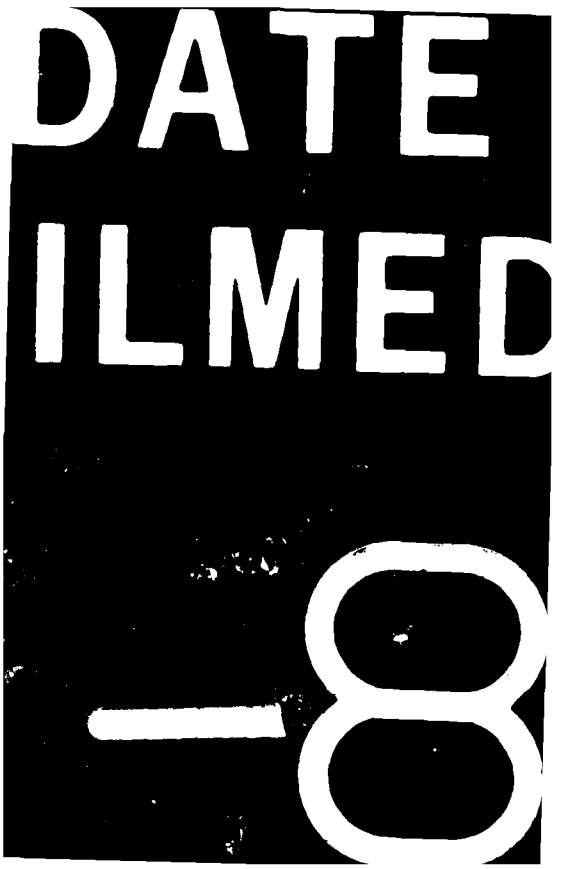
Appendix J

FREE TEXT RELEVANCE OVERLAID BY DESCRIPTOR MATCHES




DATE
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8